Physical Activity Guidelines for Americans Mid-course Report: Strategies to Increase Physical Activity Among Youth

Note to users of screen readers and assistive technologies: This report is formatted with line numbering, therefore a number will be read at the end of each line of text, beginning with the Executive Summary and Key Messages.

CONTENTS

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EXECUTIVE SUMMARY AND KEY MESSAGES

In response to a desire from both federal and non-federal stakeholders for the *2008 Physical Activity Guidelines for Americans* to be updated on a regular basis, the U.S. Department of Health and Human Services (HHS) Office of Disease Prevention and Health Promotion (ODPHP), the President's Council on Fitness, Sports & Nutrition (PCFSN), the Centers for Disease Control and Prevention (CDC), and the National Institutes of Health (NIH) formed a federal steering group to discuss this issue. Although research and new findings in the realm of physical activity continue to emerge, the group believed that the current *Physical Activity Guidelines for Americans* recommendations would change little if they were updated. Therefore, the steering group recommended a Mid-course Report, which would provide an opportunity for experts to review and highlight a specific topic of importance related to the Guidelines and to communicate findings to the public. The steering group identified "strategies for increasing physical activity among youth" as a topic area that would help to inform current practice related to the Guidelines.

Physical Activity Guidelines for Americans Mid-course Report: Strategies to Increase Physical Activity Among Youth is intended to identify interventions that can help increase physical activity in youth across a variety of settings. A subcommittee, of the PCFSN comprised of experts in physical activity was convened to examine the evidence and deliver their findings in the Mid-course Report. The subcommittee focused on physical activity in general and did not examine specific types of activity, such as muscle- or bone-strengthening physical activities. The subcommittee also did not consider efforts to reduce sedentary time or screen time. The primary audiences for the report are policy makers, health care and public health professionals, and leaders in the settings covered in the report.

Recognizing that many settings have potential for increasing physical activity among youth, the subcommittee focused on five settings in which physical activity interventions for youth have been studied and evaluated: schools, preschools and childcare facilities, community, family and home, and primary care. To assess the literature on these settings, the subcommittee and a literature review team from Washington University in St. Louis used a review-of-reviews approach.

This report discusses the importance of each of the five settings and its relation to youth physical activity, presents a review of and conclusions about the strength of evidence supporting interventions to increase physical activity, and describes research needs. The report also discusses several notable precedents for policy involvement in youth physical activity, and describes the potential for policy and

programs to further encourage increased physical activity among youth. The report concludes with a discussion of ways to create a more active future for youth by building on existing knowledge and using new technologies as well as tried-and-true methods.

The remainder of this Executive Summary highlights key findings and recommendations from the *Mid-course Report* and discusses overarching needs for future research. Table 1 provides a summary of these findings and research needs, and Table 2 provides details on the criteria used to determine the strength of evidence.

Key Findings and Recommendations

School Settings Hold a Realistic and Evidence-based Opportunity to Increase Physical Activity Among Youth

More than 95 percent of youth are enrolled in schools, and a typical school day lasts approximately 6 to 7 hours, making schools an ideal setting to provide physical activity to students.[1] Sufficient evidence is available to recommend wide implementation of multi-component school-based programs. These types of programs provide enhanced physical education (PE) (i.e., increased lesson time, delivery by well-trained specialists, and instructional practices that provide moderate-to-vigorous physical activity), as well as classroom activity breaks, activity sessions before and/or after school, and active transportation to school.

Similarly, well-designed enhanced PE in and of itself increases physical activity among youth and should be widely implemented in schools. Two additional approaches—commuting to and from school using active transport and activity breaks—show promise and are attractive because they can be implemented in situations where a full multi-component program or enhanced PE may be out of reach. Because the scientific knowledge of what works is still evolving, it is critical that, as a nation, we continue to evaluate the impact of physical activity programs in schools and ensure that effective programs are translated for a variety of audiences and widely disseminated.

Preschool and Childcare Centers That Serve Young Children Are an Important Setting in Which to Enhance Physical Activity

Millions of American children spend much of their day in structured childcare centers. More than 4.2 million young children (about 60% of children ages 3 to 5 who are not attending kindergarten) are enrolled in center-based preschools in the United States,[2] and the evidence suggests that well-designed interventions can increase physical activity among these children. Promising interventions include those

that increase time children spend outside, provide portable play equipment (e.g., balls and tricycles) on playgrounds and other play spaces, provide staff with training in the delivery of structured physical activity sessions for children and increase the time allocated for such sessions, and integrate physical active teaching and learning activities.

Changes Involving the Built Environment and Multiple Sectors Are Promising and Merit Implementation Even as the Evidence Continues to Evolve

The built environment comprises all aspects of the human-made environment, including cities, neighborhoods, buildings, roads, trails, and even water and energy infrastructure. Changes to this setting are important because they offer the potential to increase activity for all youth, not only those who elect to participate in specific programs or activities. Shifting the overall social and physical environment toward increased activity is one key strategy to address individuals' tendency to compensate for increasing physical activity in one setting by decreasing it in another setting.

Multiple national, state, and local sectors play an important role in promoting physical activity, including sectors such as transportation, urban planning, and public safety, whose primary mission is not physical activity promotion. What has yet to be tested is the added value of including these sectors in comprehensive community interventions for youth physical activity.

Media Campaigns and Technologies That Help Youth Regard Physical Activity as a Desirable and Fun Thing Are Valuable Strategies to Consider

According to the Institute of Medicine, an estimated $10 billion per year is spent on food and beverage marketing to youth. Media campaigns have been shown to increase physical activity and can balance the unhealthy messages youth are receiving through the media. The 2001–2006 VERB™ campaign, a national, multicultural, social marketing campaign coordinated by CDC and funded at $339 million over 5 years, is one recent example of a population-based approach that was effective in increasing physical activity among U.S. youth ages 9 to 13.

Today's youth are different from those who participated in VERB, and any future physical activity campaigns must incorporate technology, social media and the Internet to a greater degree. Similarly, active video games ("exergames") and mobile phone technologies are potentially promising avenues, as the use of these technologies has increased exponentially in recent years. Although evidence is not yet sufficient to suggest that playing active video games increases physical activity, technology in this

area is rapidly changing and should be studied for its potential positive impact on physical activity among youth.

To Advance Efforts to Increase Physical Activity Among Youth, Key Research Gaps Should be Addressed

During the development of this report, several research needs emerged that could be applied to each of the five settings addressed. Currently, reviews of physical activity in youth have limited long-term or longitudinal follow up. Extending research beyond short-term interventions can help determine the sustainability and long-term benefits of increasing physical activity among youth. Additionally, research across a variety of demographic, racial and ethnic, and socioeconomic status groups would be beneficial in determining how interventions can best be applied to specific populations. Behavioral theories underlying the interventions that yield the strongest effects in youth need further examination.

Several settings reviewed by the subcommittee, including Community, Home and Family, and Primary Care, had limited evidence about specific interventions strategies, but showed promise as an opportunity to engage youth. These settings should be highlighted as priority areas for research to better understand how interventions can be applied in both specific areas and across multiple settings to increase opportunities for physical activity.

Finally, most policy-relevant research related to youth physical activity is cross-sectional, showing associations but not permitting causal connections between the policies and programs to be drawn. In the future, longitudinal assessments and rigorous evaluation of policies and programs related to youth physical activity are particularly high priorities for future research.

Table 1. Summary of Findings and Next Steps for Research

Setting and Strength of Evidence*	Strategies to Increase Physical Activity Among Youth	Next Steps for Research
School Setting		
Multi-component *Sufficient*	• Provide enhanced physical education (PE) that increases lesson time, is delivered by well-trained specialists, and includes instructional practices that provide substantial moderate-to-vigorous physical activity, • Provide classroom activity breaks. • Create activity sessions before and/or after school, including active transportation. • Build behavioral skills. • Provide after-school activity space and equipment.	• Evaluate the translation and dissemination of effective interventions, particularly in the multi-component and PE areas. • Determine the specific strategies that contribute importantly to the success of multi-component interventions. • Examine intervention effects on overall daily and weekly physical activity levels. • Conduct intervention studies with long-term follow-up measures. • Conduct intervention studies with robust process evaluation protocols. • Compare intervention effects across race, ethnicity, and socioeconomic groups.
Physical Education *Sufficient*	• Develop and implement a well-designed PE curriculum. • Enhance instructional strategies for PE. • Provide teachers with appropriate training.	
Active Transportation *Suggestive*	• Involve school personnel in intervention efforts. • Educate and encourage parents to participate with their children in active transportation to school.	
Activity Breaks *Emerging*	• Add short bouts of physical activity to existing classroom activities. • Encourage activity during recess, lunch, and other break periods. • Promote environmental or systems change approaches, such as providing physical activity and game equipment, teacher training, and organized physical activity during breaks before and after school.	
School Physical Environment *Insufficient*	N/A	
After School *Insufficient*	N/A	

*Table 2 provides details on the criteria used to determine the strength of evidence.
N/A, Non-applicable

Table 1. Summary of Findings and Next Steps for Research (continued)

Setting and Strength of Evidence*	Strategies to Increase Physical Activity Among Youth	Next Steps for Research
Preschool and Childcare Center Setting		
Suggestive	• Provide portable play equipment on playgrounds and other play spaces. • Provide staff with training in delivery of structured physical activity sessions for children and increase the time allocated for such sessions. • Integrate physically active teaching and learning activities into pre-academic instructional routines. • Increase time that children spend outside.	• Conduct longitudinal, observational studies with rigorous measures and 2 to 3 year follow-up. • Examine specific strategies to promote physical activity in the childcare setting. • Conduct policy research to examine the effects of state and institutional policy innovations. • Examine the effect of a center's physical environment on child physical activity. • Investigate center-based interventions that involve parents and home-based intervention components. • Compare intervention effects across race, ethnicity, and socioeconomic groups.
Community Setting		
Built Environment *Suggestive*	• Improve the land-use mix to increase the number of walkable and bikeable destinations in neighborhoods. • Increase residential and commercial density so that people can use methods other than driving to reach the places they need or want to visit and can use safe and attractive pathways. • Implement traffic-calming measures, such as one-way streets, bike lanes, and traffic circles.	• Conduct high-quality longitudinal studies focused on youth physical activity. • Conduct studies with longer intervention periods and long-term follow up. • Conduct quasi-experimental evaluation research on the built environment and youth physical activity, taking advantage of "natural experiments" (i.e., environmental changes implemented by policymakers and/or others). • Evaluate the effects of built environment changes on adolescent physical activity. • Develop methods to improve attendance in the programs and interventions under study. • Examine ways to convert summer camp activity into habitual activity. • Examine the role of "location in the community," particularly distance from school or home on participation and adherence. • Compare intervention effects across race, ethnicity, and socioeconomic groups.
Camps and Youth Organizations *Insufficient*	N/A	

*Table 2 provides details on the criteria used to determine the strength of evidence.
N/A, Non-applicable

Table 1. Summary of Findings and Next Steps for Research (continued)

Setting and Strength of Evidence*	Strategies to Increase Physical Activity Among Youth	Next Steps for Research
Other Community Programs *Insufficient*	N/A	
Home and Family Setting		
Insufficient	N/A	• Conduct longitudinal, observational studies to examine the relevance of family and home-based strategies throughout childhood and adolescence. • Conduct longitudinal, observational studies to delineate which components of family life influence children's physical activity behavior. • Test specific strategies that engage parents and other family members in physical activity promotion in the home setting. • Test specific strategies that enrich the home environment to favor activity over sedentary pursuits. • Compare intervention effects across race, ethnicity, and socioeconomic groups.
Primary Care Setting		
Insufficient	N/A	• Conduct randomized, controlled studies of the effectiveness of primary care counseling on physical activity behavior, using state-of-the-art physical activity measures. • Identify the optimal intensity and delivery mode of primary care physical activity interventions. • Identify the optimal age range for effective interventions in primary care settings, as well as intervention effects in healthy, normal weight as well as overweight or obese youth. • Examine strategies to promote physical activity in different primary care settings, including integrated health care, fee-for-services, and community clinics. • Conduct cost-effectiveness research to identify the most efficacious intervention once promising interventions are identified. • Compare intervention effects across race, ethnicity, and socioeconomic groups.

*Table 2 provides details on the criteria used to determine the strength of evidence.

N/A, Non-applicable

INTRODUCTION

Regular physical activity in children and adolescents promotes health and fitness.[3] Compared to those who are inactive, physically active youth have higher levels of cardiorespiratory fitness and stronger muscles. They also typically have lower body fatness. Their bones are stronger and they may have reduced symptoms of anxiety and depression.

Youth who are regularly active also have a better chance of a healthy adulthood. In the past, chronic diseases, such as heart disease, hypertension, or type-2 diabetes have been rare in youth. However, a growing literature is showing that the incidence of these chronic diseases and their risk factors are now increasing among children and adolescents.[4] Regular physical activity makes it less likely that these risk factors and resulting chronic diseases will develop and more likely that youth will remain healthy as adults.

Key Terms

In this report, we use the terms:

- **youth** to include children ages 3 to 11 and adolescents ages 12 to 17, and
- **physical activity** to refer to bodily movement that enhances health. It includes moderate-intensity activities, such as skateboarding or softball, and vigorous-intensity activities, such as jumping rope or running.

Current Levels of Physical Activity Among Youth

Despite the importance of regular physical activity in promoting lifelong health and well-being, current evidence shows that levels of physical activity among youth remain low, and that levels of physical activity decline dramatically during adolescence. Opportunities for regular physical activity are limited in many schools; daily physical education (PE) is provided in only 4 percent of elementary schools, 8 percent of middle schools, and 2 percent of high schools.[5] The Youth Risk Behavior Surveillance System (YRBSS), which collects self-reported physical activity data from high school students across the United States, found that many youth are not meeting the Guidelines recommendation of 60 minutes of physical activity each day:[6]

The Benefits of Physical Activity for Youth

- Improves cardiorespiratory fitness.
- Strengthens muscles and bones.
- Helps attain/maintain healthy weight
- Reduces likelihood of developing risk factors for later diseases, such as high blood cholesterol, high blood pressure, and type-2 diabetes, thus increasing the chances that youth will remain healthy adults.
- May reduce symptoms of anxiety and depression.

- 29 percent of high school students participated in at least 60 minutes per day of physical activity on each of the 7 days before the survey. Boys were more than twice as likely to meet the Guidelines as girls (38% vs. 19%).
- 14 percent of high school students did not participated in 60 or more minutes of any kind of physical activity on any day during the 7 days before the survey.

A separate study of youth in the United States used accelerometers to objectively measure physical activity. This study found that 42 percent of children and only 8 percent of adolescents were active in moderate- to vigorous-intensity activity on 5 of the past 7 days for at least 60 minutes each day.[7]

The 2008 Physical Activity Guidelines for Americans

In 2008, the U.S. Department of Health and Human Services (HHS) issued the first comprehensive guidelines on physical activity for individuals ages 6 and older. The *2008 Physical Activity Guidelines for Americans* provide information on the amount, types, and intensity of physical activity needed to achieve health benefits across the lifespan.[8]

The Guidelines provide physical activity guidance for youth ages 6 to 17 and focus on physical activity beyond the light-intensity activities of daily life, such as walking slowly or lifting light objects. As described in the Guidelines, youth can achieve substantial health benefits by doing moderate- and vigorous-intensity physical activity for periods of time that add up to 60 minutes or more each day. This activity should include aerobic activity as well as age-appropriate muscle- and bone-strengthening activities (see box).

Key Guidelines for Children and Adolescents

- Children and adolescents should do 60 minutes (1 hour) or more of physical activity daily.
  - **Aerobic**: Most of the 60 or more minutes a day should be either moderate- or vigorous-intensity aerobic physical activity, and should include vigorous-intensity physical activity at least 3 days a week.
  - **Muscle-strengthening**: As part of their 60 or more minutes of daily physical activity, children and adolescents should include muscle-strengthening physical activity on at least 3 days of the week.
  - **Bone-strengthening**: As part of their 60 or more minutes of daily physical activity, children and adolescents should include bone-strengthening physical activity on at least 3 days of the week.
- It is important to encourage young people to participate in physical activities that are appropriate for their age, that are enjoyable, and that offer variety.

Current science suggests that as with adults, the total amount of physical activity is more important in helping youth achieve health benefits than is any one component (frequency, intensity, or duration) or specific mix of activities (aerobic [e.g., tag, bike riding], muscle-strengthening [e.g., push-ups, climbing trees], or bone strengthening [e.g., hopscotch, tennis]).

Parents and other adults who work with or care for youth should be familiar with the Guidelines, as adults play an important role in providing age-appropriate opportunities for physical activity. They need to foster active play in children and encourage sustained and structured activity in adolescents. In doing so, adults help lay an important foundation for lifelong health, for youth who grow up being physically active are more likely to be active adults.[8]

The Mid-course Report: Building on the Physical Activity Guidelines

In response to a desire from both federal and non-federal stakeholders for the *Physical Activity Guidelines for Americans* to be updated on a regular basis, a federal steering group including representatives from the HHS Office of Disease Prevention and Health Promotion (ODPHP), the President's Council on Fitness, Sports & Nutrition (PCFSN), the Centers for Disease Control and Prevention (CDC), and the National Institutes of Health (NIH) was formed to discuss this issue. Although research and new findings in the realm of physical activity continue to emerge, the group believed that the current Guidelines recommendations would change little if they were updated. Therefore, the steering group recommended a *Mid-course Report*, which would provide an opportunity for experts to review and highlight a specific topic of importance related to the Guidelines and to communicate findings to the public. With expertise from the PCFSN Science Board and coordination by ODPHP and PCFSN staff, the steering group identified "strategies for increasing physical activity among youth" as a topic area that would help to inform current practice related to the Guidelines.

A subcommittee of the PCFSN was convened in spring 2012 with the approval of HHS Secretary Kathleen Sebelius and the Assistant Secretary for Health, Dr. Howard Koh. The subcommittee was comprised of experts in school- and community-based interventions, policy, exercise physiology, epidemiology, measurement/quantification and assessment of physical activity, childhood obesity, public health, and environmental influences on physical activity and chaired by President's Council Member, Dr. Risa Lavizzo-Mourey. The ODPHP was responsible for coordinating the subcommittee's work.

The subcommittee was asked to review the evidence on strategies to increase youth physical activity and make recommendations. It conducted its work through biweekly conference calls and three

in-person meetings held in May, August, and October, 2012. The subcommittee's findings and recommendations are summarized here in the *Physical Activity Guidelines for Americans Mid-course Report: Strategies to Increase Physical Activity Among Youth*.

The *Mid-course Report* is intended to identify interventions that can help increase physical activity in youth across a variety of settings. The subcommittee focused on physical activity in general and did not examine specific types of activity, such as muscle- or bone-strengthening physical activities. The subcommittee also did not consider efforts to reduce sedentary time or screen time. The primary audiences for the report are policy makers, health care and public health professionals, and leaders of the settings covered in the report.

Even though the *2008 Physical Activity Guidelines for Americans* does not include specific recommendations for children younger than age 6, the subcommittee expanded its review to include children ages 3 to 5. This decision was made in light of the fact that physical activity for young children is necessary for healthy growth and development.[8] The environments in which young children spend their days are often less structured than the formal school environments of later childhood and adolescence, thereby providing opportunities for the free play and unstructured physical activity that are important for this age group. The subcommittee's consideration of this young age group also is consistent with the recommendations of the Institute of Medicine's 2011 report *Early Childhood Obesity Prevention Policies*[9] and the recommendations of several countries, including Australia and the United Kingdom, that have developed physical activity guidelines for infants and young children.[10–12]

Organization of the Report

The *Mid-course Report* consists of three major components. The first component, which includes the Introduction and Methods sections, describes the background and context for the *Report* and the process by which the subcommittee reviewed the evidence and developed its recommendations.

The second component, Results by Intervention Setting, focuses on five settings that are central to the lives of youth. Each section within this component discusses the importance of the setting and its relationship to youth physical activity, presents a review of and conclusions about the strength of evidence supporting interventions to increase physical activity, and describes research needs. A final section in this component discusses several notable precedents for policy involvement in youth physical activity and describes the potential for policy and programs to further encourage increased physical activity among youth.

The third component, Additional Approaches to Build a More Active Future for Youth, explains that in developing strategies to increase physical activity in youth, much can be learned from the successes of the past, most notably the VERB™ campaign. This section also describes ways to capitalize on these successes by incorporating the interests, characteristics, and social media habits of today's youth in future physical activity interventions.

The *Report* contains a number of terms important to physical activity and health. Definitions of these terms can be found in the *2008 Physical Activity Guidelines for Americans Glossary* (http://www.health.gov/paguidelines/guidelines/glossary.aspx).

METHODS

The CDC contracted with Washington University researchers at the Prevention Research Center (PRC) in St. Louis to conduct the literature review for the *Physical Activity Guidelines for Americans Mid-course Report*. A team from the PRC used Washington University library services to carry out the literature review, which was coordinated by the ODPHP and the CDC Division of Nutrition, Physical Activity, and Obesity, Physical Activity and Health Branch. The subcommittee and the PRC team together determined that the literature review team would use a review-of-reviews approach to assess the current literature on interventions to increase physical activity in youth. When more than one narrative or systematic review has been published, the use of this methodology facilitates the examination and comparison of intervention strategies and results because it allows for the translation and synthesis of knowledge across multiple reviews that include multiple studies. A limitation of the review-of-reviews method used for this report is that individual studies were not examined for their contribution to the findings. In addition, the review-of-reviews methodology did not allow the subcommittee to identify specific theories that could be used to structure potentially effective interventions.

Because the PRC team had used the review-of-reviews approach previously, they took the lead in determining the operational plan and literature review process with regular consultation from the subcommittee. A representative from the PRC team participated in the subcommittee's meetings to provide regular updates on the literature review process and to answer subcommittee questions about findings from the literature.

Conceptual Framework

The subcommittee used the socio-ecological model to identify settings where youth live, learn, and play. Recognizing that many settings have potential for increasing physical activity among youth but that evidence across the settings varies, the subcommittee focused on five in which physical activity interventions for youth have been studied and evaluated: schools, preschools and childcare centers , community, family and home, and primary care.

Literature Review

The review-of-reviews process to assess the current level of evidence for physical activity interventions in youth began in summer 2012 and continued through early fall 2012. Using the seven-step process described below, the PRC team identified review articles published from January 2001 through July 2012, determined which articles should be included based on inclusion and exclusion criteria developed by the subcommittee , and then abstracted and synthesized the data. A total of 31 reviews containing 910 studies ultimately were included.

A key inclusion criterion was the measurement of physical activity as an intervention outcome. Because physical activity measures must be consistent with the intervention targets, physical activity assessment measures included in the reviews covered by this review-of-reviews were device-based measures, self-report, and direct observations. In cases where a particular aspect of physical activity was the intervention target, self-report measures or direct observation that can identify specific behaviors were deemed to be preferable to device-based measures, which cannot identify behaviors or context.

Inclusion and Exclusion Criteria for the Review-of-Reviews

Inclusion Criteria

- Youth ages 3–17 years
- English language
- Peer-reviewed literature of intervention studies
- Systematic reviews and meta-analyses
- Reviews published January 2001 through July 2012
- Interventions must measure physical activity as an outcome
- Interventions including technology approaches to promote physical activity
- Primarily healthy population
- Results must be available specifically for children or adolescents

Exclusion Criteria

- Interventions focused on limiting screen time
- Interventions focused on decreasing sedentary behavior
- Interventions focused solely on weight loss
- Review containing only cross-sectional data

The literature search and synthesis process involved the following steps:

1. **Select Database(s) Most Likely to Yield the Desired Document Types.** The search for reviews of physical activity interventions in any language was conducted using the following databases: Database of Abstracts of Reviews of Effects (DARE), the Cochrane library, Turning Research Into

Practice, PubMed (Medline), the American Psychological Association, and National Guidelines Clearinghouse.

2. **Determine Search Parameters and Conduct the Search.** The evidence resources reviewed and abstracted were limited to those published between January 2001 through July 2012, plus articles accepted for publication in English-language, peer-reviewed journals. Search terms included: "physical activity," "interventions," "systematic review," "meta analysis," "child," and "adolescent." The Washington University library system was used to conduct the search.

3. **Screen the Titles and Abstracts to Determine Potential Relevance.** The results were automatically filtered through the databases for date (January 2001 through July 2012) and English language. One reviewer then manually filtered the titles and abstracts for age of the populations in the reviews. Two reviewers examined the databases and included all titles and abstracts that met the inclusion criteria, as well as those for which the applicability of the inclusion criteria could not be determined. These same two reviewers then examined the abstracts for further information regarding inclusion.

4. **Obtain Selected Documents.** The literature review team obtained copies of the complete articles selected through the Washington University library system.

5. **Perform an Initial Synthesis to Determine Inclusion.** Relevant review articles were screened to ensure each document met the inclusion criteria outlined in Table 2.

6. **Abstract Selected Review Articles and Summarize.** All relevant articles that met the inclusion criteria were summarized and information was abstracted to create detailed evidence tables. These tables included the following information:

    - Methodological information: reference, year of publication, objective, type of review (systematic, narrative), type of studies/methods reviewed (e.g., randomized controlled trial, quasi-experimental design), review methods, number of included studies, year of publication, study populations and settings, independent variables, dependent variables.
    - Intervention information: type of intervention, age group, focus on high-risk population, setting, number of studies, number of children, countries/region of studies.
    - Results: main conclusion, race/ethnic groups and low socioeconomic status group estimates. (Note: Effect size estimates and sufficient information for calculating pooled mean effect

sizes were collected but the information was not sufficient to make comparisons across population subgroups.)

- Information to determine level of evidence: Determined in part by type of studies/methods reviewed and assessed as a component of "methodological information."

Using the information contained in the evidence tables, the literature review team then collectively and systematically reviewed physical activity intervention strategies to assess their effectiveness. Emerging intervention strategies were assessed, reviewed, and reported when available, but many were so recent that they had not yet been incorporated into systematic evidence reviews and therefore may not have been included in the *Mid-course Report*.

7. **Synthesize Evidence.** The final step was to synthesize the evidence by setting. To determine the quality, strength, and consistency of the available evidence for each of these settings and sub-topics, the subcommittee reviewed the evidence tables and used the most relevant reviews. The most relevant reviews were those dedicated to the setting (if available), those with sections dedicated to the setting (if available), or those with discussion/conclusions dedicated to the setting. The evidence within each of these settings was then classified into one of the following categories (sufficient, suggestive, insufficient [including emerging or no evidence], or evidence of no effect) developed by the subcommittee using the specific criteria contained in Table 2.

Table 2. Assessing the Strength of Evidence of Reviews

Evidence of Effectiveness	Adequate evidence	Consistency across reviews	Addresses methodological issues	Specificity of intervention	# subjects/ sites	#/breath of studies	Representation	Duration of intervention
Sufficient	Likely/high probability	Likely/high probability	Likely/high probability	Yes	Adequate	Adequate	Adequate	Adequate
Suggestive	Possibly	Possibly	Possibly	Varies	Acceptable	Acceptable	Acceptable	Acceptable
Insufficient • **Emerging evidence** • **No evidence**	Varies	Possibly	Possibly	Varies	Limited	Limited	Limited	Limited
Evidence of no effect	Likely/high probability	Likely/high probability	Likely/high probability	Yes	Adequate	Adequate	Adequate	Adequate

Definitions

Sufficient: Consistent beneficial effects documented across studies and populations
Suggestive: Reasonably consistent evidence of effect, but cannot make strong definitive conclusion
Insufficient: Do not have enough evidence to make a conclusion
Emerging evidence: New data, currently being studied, but reviews do not exist yet
No evidence: Evidence within review articles does not exist in this area
Evidence of no effect: Consistent lack of effect documented across studies and populations

RESULTS BY INTERVENTION SETTING

School Setting

More than 55 million children were expected to attend public or private school in the fall of 2012[13] and a typical school day lasts approximately 6 to 7 hours, making schools an ideal setting to provide physical activity to students.[1] School-based physical activity can provide a substantial amount of students' daily physical activity as well as engage them in opportunities to enhance their motor skill development, fitness, and decision making, cooperation, and conflict resolution skills.[14–21] Promoting physical activity in schools has traditionally been a part of the U.S. education system, and schools continue to play a critical role in promoting physical activity. Schools are a key setting for physical activity interventions because of a growing body of research focusing on the association between physical activity and academic achievement. These studies indicate that school-based physical activity can improve grades, standardized test scores, cognitive skills, concentration, and attention.[5]

The scientific literature relevant to the schools setting and physical activity in youth describes an array of strategies. For this report, schools-related literature is separated into the following areas:

- Multi-component school-based interventions.
- Physical education.
- Active transportation to school.
- Activity breaks.
- School physical environment.
- After-school interventions.

Multi-component School-based Interventions

Multi-component interventions are those in which two or more intervention strategies are concurrently implemented. In the school setting, such interventions have typically been carried out by school staff who interact with interventionists (often university-based). These interventions have usually included a component that aimed to enhance the PE program. Enhancing a PE program is done through increasing physically active time in PE class, adding more PE to the school curriculum, and/or

lengthening the PE class time (see the box on Enhanced PE, p. 20). Other strategies include health education, classroom physical activities, enhanced recess, social marketing campaigns, before- and after-school programs, active transportation to school, parent and family involvement, and physical environment enhancements.

Conclusion

Evidence is sufficient that multi-component school interventions can increase physical activity during school hours among youth. Effective strategies include:

- **Providing enhanced PE that increases lesson time, is delivered by well-trained specialists, and emphasizes instructional practices that provide substantial moderate-to-vigorous intensity physical activity.**
- **Providing classroom activity breaks.**
- **Developing activity sessions before and/or after school, including active transportation.**
- **Building behavioral skills.**
- **Providing after-school activity space and equipment.**

Supporting Discussion

The majority of the evidence about this setting originates from seven relevant reviews that focused solely on the school setting.[22–28] Findings from these reviews indicate that multi-component interventions with educational, curricular, and environmental components are more effective than are isolated education or curricular components. Successful strategies include intervening over an entire school year, integrating programs into the regular school curriculum, offering enhanced PE as one of the components, providing behavioral modification lessons and educational materials, and involving families. Evidence indicates that offering physical activity breaks and after-school activity space and equipment, as well as increasing time in PE, are effective. The most effective strategies differed by age.[23, 24] For instance, among children, PE combined with activity breaks (e.g., recess, classroom PE breaks) or with family strategies (e.g., engaging parents by sharing written information about physical activity) were most successful.[24] Among adolescents, evidence for including both school and family or community components is strong.[23] Although multi-component school interventions are effective in

increasing physical activity during school hours, these interventions are less effective at increasing physical activity outside of school.

Physical Education

Physical education (PE) provides students the opportunity to obtain the knowledge and skills needed to establish and maintain a physically active lifestyle through childhood and adolescence and into adulthood (National Association for Sport and PE).[29] Physical education can enhance students' knowledge and skills about why and how they should be physically active,[15, 21] increase participation in physical activity, and increase fitness.[15, 30–35]

Traditionally, PE has been characterized by sports- and performance-based curriculum and instruction. A newer approach—enhanced PE—is characterized by a focus on increasing overall physical activity, particularly moderate-to-vigorous intensity physical activity during PE class.

Enhanced PE

Enhanced PE can increase the amount of time students are active during PE classes as well as increase students' physical fitness levels. Enhanced PE is characterized by the following components:

- Increasing the amount of time students spend in moderate-to-vigorous intensity physical activity during PE lessons.
- Adding more physical education classes to the school curriculum.
- Lengthening the time of existing physical education classes.
- Meeting the physical activity needs of all students, including those with disabilities.
- Including activities that are enjoyable for students while emphasizing knowledge and skills that can be used for a lifetime.

Conclusion

Evidence is sufficient that enhanced PE can increase overall physical activity among youth and can increase physical activity time during PE class. Effective strategies include:

- **Developing and implementing a well-designed PE curriculum.**
- **Enhancing instructional strategies for PE.**
- **Providing teachers with appropriate training.**

Supporting Discussion

Seven reviews were identified that were either specifically focused on PE or had separate sections about PE.[15, 22, 24, 36–39] Five of the seven reviews did assess methodological quality of the studies included in the review, while two reviews did not assess methodological quality. Two reviews were broader in scope (i.e., part of a comprehensive school-based intervention review) and included a section on PE.[15, 22] Four reviews evaluated interventions in multiple settings, but had a section on PE.[24, 37–39]

Across the reviews, results indicated that improvements in PE, and therefore in youth physical activity participation, can happen through implementation of strategies either individually or in combination. The overarching PE strategies that were reported to be most effective are changes to the curriculum, selection of lessons to increase physical activity time in PE, and classroom management skills implemented by PE teachers. A well-designed PE curriculum, for example, describes what students should know and be able to do as a result of the PE program, includes lessons that focus on behavior modification and intrinsic motivation, includes lessons focused on keeping students active the majority of class time, and adds fitness and circuit training stations to lesson plans. Enhancing instructional strategies, such as modifying rules of games (e.g., having all students run bases in softball) or substituting less active games with more active ones helps maximize the inclusion of all students in PE. Finally, employing qualified PE teachers (e.g., certified, licensed, or endorsed to teach PE) and providing teachers with adequate and appropriate training is important to enhance PE and keep students in moderate-to-vigorous intensity physical activity for the majority of class time. Training for PE teachers should include strategies for classroom management, how to keep transitions between activities physically active, and how to implement the PE curriculum. The included reviews indicate that these strategies can significantly contribute to a child's overall total moderate-to-vigorous intensity physical activity and increase activity time in PE.

Active Transportation to School

More than 95 percent of youth are enrolled in schools. Thus, addressing active transportation to school has the potential to affect the physical activity of a substantial portion of the youth population. Active transportation to school has been defined as "the use of active means, such as walking and bicycling, to and from school."[40] Active transportation to school has decreased from approximately 41 percent in 1969 to 13 percent in 2001.[41] These falling rates of active transportation to school have prompted policy initiatives, such as Safe Routes to School, and inclusion of active transportation

objectives in Healthy People 2020,[42] the 10-year national objectives for improving the health of all Americans. The falling rates also have encouraged researchers to examine and create interventions that address active transportation to school.

Conclusion

Evidence is suggestive that active transportation to school increases physical activity among youth. Effective strategies include:

- **Involving school personnel in intervention efforts.**
- **Educating and encouraging parents to participate with their children in active transportation to school.**

Supporting Discussion

Three reviews specific to active transportation to school were identified.[40, 43, 44] One included intervention studies,[40] while the others provided cross-sectional evidence. Additionally, four other reviews included active transportation to school as part of their discussion regarding strategies to increase physical activity.[15, 45–47] The existing cross-sectional evidence shows clear associations between active transportation to school and physical activity. On average, the intervention studies show small, but positive, effects.

The one review of interventions included 14 studies specifically focused on active transportation to school.[40] The degree of change in physical activity varied from 3 percent to 64 percent, with nine studies showing trivial or small effect sizes, two showing large effect sizes, and one showing very large effect sizes. Effect size could not be calculated for two studies.

Several different strategies, such as forming walking school buses, providing curricula and resources, and improving safety of school routes by identifying the safest routes, were included across the interventions. Some study designs were weak, so it is difficult to recommend a particular mode or type of programming that works best. However, studies with the greatest effect size indicated that involving school personnel and educating and encouraging parents were important intervention components.[40] Additionally, the walking school bus was implemented in approximately half of the studies showing moderate-to-very large effect size.[40]

Activity Breaks

The school setting can offer opportunities for students to participate in and enjoy physical activity outside of PE class. Such opportunities are referred to as activity breaks. Most often, the overarching strategy behind activity breaks has been to establish an environment that promotes regular physical activity throughout the school day. This can occur through 5- to 10-minute breaks during classroom time that may or may not include subject matter curriculum or by increasing physical activity opportunities during traditional school day breaks, such as recess and lunch time.

Conclusion

Evidence is emerging that school-based physical activity breaks can increase physical activity among youth. Effective strategies include:

- **Adding short bouts of physical activity to existing classroom activities.**
- **Encouraging activity during recess, lunch, and other break periods.**
- **Promoting environmental or systems change approaches, such as providing physical activity and game equipment, teacher training, and organized physical activity during breaks and before and after school.**

Supporting Discussion

Seven relevant reviews were identified.[15, 22, 24, 36–39] Two of the reviews evaluated interventions from many settings and had a section dedicated to activity breaks.[24, 47] Four of the reviews evaluated interventions in multiple settings, but did not have a section dedicated to a review of studies that focused on activity breaks.[27, 28, 36, 48] However, they did include at least one intervention that used activity breaks, and they provided some conclusion or discussion about the topic.

Of the two reviews that had a section on activity breaks, interventions incorporated structured physical activity sessions into the school day, added physical activity into usual classroom activities, and used adults to encourage activity during classroom breaks, such as recess or lunch. The four reviews that evaluated interventions in multiple studies did identify that strategies, such as providing game equipment during recess and lunch breaks; organizing physical activities during, before, and after school times; and increasing the availability of physical activity opportunities, combined with other

environmental strategies, can increase students' physical activity. However, it is difficult to make conclusions about the isolated impact of physical activity breaks on youth physical activity, given that the reviews included studies were multi-component programs and activity breaks were only one of many intervention strategies.

School Physical Environment

In recent years, researchers have begun to focus on an ecological perspective that considers environmental factors when examining and designing programs to increase youth physical activity.[49] School physical environment is defined as the physical surroundings affiliated with any given school, including the school's neighborhood and grounds, building design, facilities, and equipment.[50] Although some aspects of school physical environment may be related to the built environment (see p. 29 for more details on physical activity and the built environment), studies of school physical environment often consider other aspects, such as portable equipment and availability of resources. Researchers also often address other aspects of school environment, such as social environment, in their physical activity interventions. The social aspects of the school environment may be important intervention targets, but are not addressed here.

Conclusion

Evidence is insufficient that interventions to modify the school physical environment alone increase physical activity in youth.

Supporting Discussion

A total of 14 reviews were identified. None specifically focused on the school physical environment setting. One review that focused on multiple settings addressed school physical environment separately.[25] Ten reviews included school environment as a single component of multi-component approaches.[17, 27, 30, 40, 52–57] Three other reviews,[24, 26, 49] which focused on multi-component interventions, included school physical environment in their discussions but noted that evidence about this topic is insufficient to draw conclusions.

Intervening on the school environment alone is not typical, in part because of the feasibility and/or cost limitations of changing aspects of the school physical environment, such as building design. In the

one review that focused on multiple settings, four studies addressed children, and one addressed adolescents.[25] Three of these five studies were considered relatively low-quality randomized clinical trials and had limited evidence (children) or inconclusive evidence (adolescents) of school physical environment affecting physical activity. In the 10 reviews that included school physical environment as one component of a multi-component approach, the lack of information made it difficult to separate the effects of the physical environment itself from other components of the intervention.

After-school Interventions

After-school interventions aim to increase physical activity outside of the regular school day. These interventions may be carried out within the school setting or in the community, such as at community centers or YMCAs. Schools and community organizations often collaborate to provide after-school physical activity interventions.

After-school interventions can be developed and delivered by school staff, teachers, community volunteers, and leaders of community-based after-school programs. They can either be stand-alone programs that solely focus on physical activity or they can be a component of a larger extracurricular or enrichment program.

Conclusion

Evidence is insufficient that promoting physical activity in an after-school setting increases physical activity among youth.

Supporting Discussion

Two narrative reviews[51, 52] and one meta-analysis[53] examined intervention studies that sought to increase youth physical activity in the after-school setting. Three narrative reviews[24, 47, 54] were broader in scope and included the after-school setting as part of an overarching review of interventions to increase youth physical activity. Taken together, the reviews suggest interventions to increase physical activity in the after-school setting may be a promising strategy, although their effectiveness to date has not been shown.[53]

After-school activity intervention programs are generally well-received and enjoyed by youth and parents.[52] The reviews suggest that investigators consider several key implementation strategies in

future studies, such as targeting physical activity alone, rather than targeting multiple outcomes, and locating after-school interventions in schools to remove transportation as a barrier.[51]

Next Steps for Research in the School Setting

- **Evaluate the translation and dissemination of effective interventions, particularly in the multi-component and PE areas.**
- **Determine the specific strategies that contribute importantly to the success of multi-component interventions.**
- **Examine intervention effects on overall daily and weekly physical activity levels.**
- **Conduct intervention studies with long-term follow-up measures.**
- **Conduct intervention studies with robust process evaluation protocols.**
- **Compare intervention effects across race, ethnicity, and socioeconomic groups.**

Preschool and Childcare Center Setting

Early care and education centers that serve preschool age children are important settings in which to provide physical activity for young children. First, millions of American children spend much of their day in structured childcare centers. More than 4.2 million young children (about 60% of children ages 3 to 5 who are not attending kindergarten) are enrolled in center-based preschools in the United States.[2] Second, studies have shown that substantial percentages of young children are less physically active than recommended by public health authorities.[9] Hence, there is a need to consider promoting physical activity through the centers that serve preschoolers. Third, observational research has found associations between characteristics of the child care environment and children's physical activity.[55–57] For example, children attending preschools with larger playgrounds engaged in more physical activity than did children in preschools with smaller playgrounds,[57] and large playgrounds with open space were associated with higher physical activity levels.[57–60] Further, children were more active in outdoor spaces with less fixed equipment, such as jungle gyms and balance beams.[56, 57, 59] In addition, preschoolers with access to portable playground equipment, such as tricycles, balls, and hoops, tended to be more active than children exposed only to fixed play equipment.[57, 59, 60]

Conclusion

Evidence is suggestive that interventions to modify the social and/or physical environment in early care and education centers can increase physical activity among young children during the school day. Strategies, applied independently or collectively, that may increase physical activity include:

- **Providing portable play equipment on playgrounds and other play spaces.**
- **Providing staff with training in delivery of structured physical activity sessions for children and increasing the time allocated for such sessions.**
- **Integrating physically active teaching and learning activities into pre-academic instructional routines.**
- **Increasing time that children spend outside.**

Supporting Discussion

Although eight reviews were identified, the majority of the evidence originates from three reviews that focused solely on the childcare setting.[61–63] Portable play equipment, but not fixed equipment or playground markings, appear likely to stimulate more physical activity. Teachers' knowledge about physical activity and motor development and their ability to support children's learning and development is important. Therefore, policies promoting structured physical activity also should consider the need for teacher training. Physical activity can and should be integrated into the daily routines and existing curricula of preschools and must not be seen as something that competes with other educational goals. Research also suggests that regularly provided, structured physical activity programs can increase the amount and intensity of physical activity and improve motor skills. However, programs to increase structured physical activity should not be carried out at the expense of children's free play.

Next Steps for Research in the Preschool and Childcare Center Setting

- **Conduct longitudinal, observational studies with rigorous measures.**
- **Examine specific strategies to promote physical activity in the childcare setting.**
- **Conduct policy research to examine the effects of state and institutional policy innovations.**
- **Examine the effect of the center physical environment on child physical activity.**
- **Investigate center-based interventions that involve parents and activities at home.**
- **Compare intervention effects across race, ethnicity, and socioeconomic groups.**

Community Setting

The community setting has enormous potential to increase physical activity in youth by shaping the sociocultural and physical environments where they live, learn, and play. Intervening in community settings can affect activity at the population level, thus potentially providing opportunities and encouragement for all youth to be more active.

The Guide to Community Preventive Services[64] defines "community" as: *A group of individuals sharing one or more characteristics such as geographic location (e.g., a neighborhood), culture, age, or a particular risk factor*. Consistent with the Community Guide, the broadest possible use of the term "community" was applied while reviewing and summarizing the relevant literature in this area.

The scientific literature relevant to the community setting and physical activity in youth describes an array of strategies, including structural changes to the built environment as well as informational and programmatic interventions conducted in various community locations. For this report, the community-related literature is separated into the following general areas:

- The built environment.
- Programmatic interventions offered in camps and youth organizations.
- Other community-based programs.

After-school programs, often led by community groups, have been described previously in the School setting section of this report.

Built Environment

The built environment comprises all aspects of the human-made environment, including cities, neighborhoods, buildings, roads, trails, and even water and energy infrastructure. Changes in this setting are important because they offer the potential to increase activity for all youth, not only those who participate in specific programs or activities. The features of the built environment most relevant to physical activity in youth include parks and recreation facilities, transportation systems, and urban planning aspects such as sidewalks and local zoning decisions. Research suggests that youth active transportation (i.e., walking or biking to school or other destinations) is influenced by aspects of the built environment, including neighborhood walkability, provision of sidewalks, and reasonable distances

for youth to walk or bike to school.[65] (Active transportation to school is addressed in more detail in the School section of this report, see p. 21).

Modifications to the built environment have previously been recommended as a way to increase activity levels in the general population.[37, 64, 66–70] However, few studies have focused on the built environment and its influence on youth activity.[71, 72]

Conclusion

Evidence is suggestive that modifying aspects of the built environment can increase physical activity among youth, particularly:

- **Improving the land-use mix to increase the number of walkable and bikeable destinations in neighborhoods.**
- **Increasing residential and commercial density so that people can use methods other than driving to reach the places they need or want to visit and can use safe and attractive pathways.**
- **Implementing traffic-calming measures, such as traffic circles and speed bumps.**

Evidence also suggests that changes in the following increases activity in children:

- **Access to, density of, and proximity to parks and recreation facilities.**
- **Walking and biking facilities, such as sidewalks and biking trails.**
- **Walkability.**
- **Pedestrian safety structures, such as traffic lights.**
- **Vegetation.**
- **Traffic speed and volume (lower speed was associated with increased activity).**
- **Incivilities and disorders, such as litter and vacant or poorly-maintained lots (reduced incivilities were associated with greater activity).**

Supporting Discussion

Two published reviews assessed aspects of the built environment and youth activity,[24, 72, 73] although only one[72] focused solely on physical activity in youth and the built environment. One of these was a systematic review of 103 studies that assessed many dimensions of the built environment—both

perceived and objective—related to self-reported and objective measures of activity in youth. The other review[73] evaluated interventions or associations with youth activity that included the built environment as one of many possible influences. This review[73] systematically reviewed only prospective studies. Although some intervention studies were included in the reviews, most studies were cross-sectional, as is typical for this nascent field. Traditional research-initiated interventions in the built environment are often extremely difficult to undertake, given time, expense, jurisdiction, and other logistical considerations.

The systematic review of the 103 studies[72] provides the most comprehensive assessment of the built environment and youth activity, and its findings serve as the basis for our conclusions.

Associations were found between youth activity and traffic-related safety, but not to crime-related safety. However, this may be an artifact of the measures used in studies assessing crime-related safety and the physical activity and review methodology.[72]

These conclusions related to those aspects of the built environment and increased youth activity are largely consistent with findings from literature on youth active commuting, and literature on the built environment and the general population.

Camps and Youth Organizations

Communities often offer physical activity opportunities outside of the traditional school setting as part of youth organizations, such as scouting, or places, such as camps. Camps are defined as places, often in rural areas, used for recreation or instruction and often held during the summer. Scouting is defined as activities of various national and international organizations that help youth develop character, citizenship, and individual skills.

Many youth attend camps or scouting activities as part of their participation in community organizations. For example, approximately 5 million youth participate in either the Girls Scouts or Boy Scouts of America. Because of their broad reach, camps and scouting organizations are promising venues by which to improve youth physical activity. Camps and scouting organizations increase youth physical activity through strategies, such as providing opportunities for youth to be active during the camp or scouting experiences, or by creating incentives for physical activity as part of organizational goals or policies. The reviews discussed in this section of the report primarily covered the first strategy.

Conclusion

Evidence is insufficient that promoting physical activity in a camp or youth organization setting increases physical activity among youth.

Supporting Discussion

Three narrative reviews included the summer camp or scouting setting, although no review specifically focused on interventions to increase physical activity in either of these settings.[39, 47, 54] Two of the reviews[39, 47] comprehensively evaluated summer camp or scouting interventions and included a section on physical activity in their conclusions. The third review[54] did not provide summary information about physical activity interventions in the summer camp or scouting setting.

Taken together, the reviews concluded that using summer camp or scouting strategies to increase youth physical activity may be a promising intervention strategy, although its effectiveness has not yet been shown.

In the summer camp setting, physical activity has been promoted along with other strategies, such as Internet-based education.[74] Interventions in Girl Scouts have successfully used troop leaders to deliver an educational curriculum along with modifications to troop meeting policies and badge assignments to increase physical activity.[75] Interventions conducted as part of scouting or summer camps also have used accelerometry and self-report methods to measure physical activity. These few studies had mixed results, but suggest that this setting may provide promising opportunities for youth to increase physical activity.

Other Community-based Programs

The Guide to Community Preventive Services[64] defines community-based interventions as those "conducted within and by members of a particular community (e.g., grassroots efforts, efforts by a local civic group)." Community-based programs in youth are carried out in diverse settings, including community centers and recreation facilities, churches, housing projects, and school facilities. They are conducted outside of school day hours or on weekends.

Conclusion

Evidence is insufficient that intervention strategies set in the community increase physical activity among youth.

Supporting Discussion

Two systematic reviews,[48, 51] three narrative reviews,[23, 24, 39] and one recent review-of-reviews with an additional literature update[76] included interventions set in the community or in community centers. Two of the narrative reviews[23, 24] also were included in the review-of-reviews. One review focused on studies encompassing a broad definition of community; the remaining five reviews included a small number of studies of broadly defined community interventions as well as school plus community interventions as part of a multi-setting review. No review focused specifically interventions within community centers.

Few studies included in the six reviews formally examined the association between community-based interventions and youth physical activity. Among those that did, interventions were conducted outside of the school day and in a variety of settings. A mix of intervention strategies were used, including informational sessions, joint use programs, and after-school activities. The effectiveness of specific intervention strategies was difficult to ascertain because of the diverse array of intervention strategies. The majority of studies in the reviews were controlled trials. Physical activity was assessed using a variety of methods, including direct observation, self-report, pedometers, and accelerometers.

For the most part, the reviews did not provide convincing evidence of a positive effect of community strategies on physical activity in youth. Some evidence suggests that interventions developed in the school setting that include community linkages as part of a comprehensive socio-ecologic approach can increase youth physical activity. However, the findings are limited for adolescents and even more scanty for children. Providing supervised access to school playgrounds during non-school hours also shows promise, as this type of intervention was found to be associated with increased levels of physical activity in a pilot study of inner city elementary school-aged children.

Next Steps for Research in the Community Setting

- **Conduct high-quality longitudinal studies focused on youth physical activity.**
- **Conduct studies with longer intervention periods and long-term follow up.**
- **Conduct quasi-experimental evaluation research on the built environment and youth physical activity, taking advantage of "natural experiments" (i.e., environmental changes implemented by policymakers and/or others).**
- **Evaluate effects of built environment changes on adolescent physical activity.**
- **Develop methods to improve attendance in the programs and interventions under study.**
- **Examine ways to convert summer camp activity into habitual activity.**
- **Examine the role of "location in the community," particularly distance from school or home on participation and adherence.**
- **Compare intervention effects across race, ethnicity, and socioeconomic status groups.**

652

Family and Home Setting

Physical activity interventions focused on the Family and Home are designed to improve health-related behaviors and prevent obesity. This setting is logical, given that children develop physical activity behaviors, attitudes, and values in the home.[77] Parents structure much of their children's time during early childhood through adolescence, thus enabling or constraining exposure to physical activities. Parents and other caregivers also influence physical activity behaviors through their control of resources, such as through buying sporting equipment or transporting a child to lessons and sporting activities.

Research addressing physical activity correlates and determinants indicate that parents and other family members are important in explaining differences in physical activity levels among youth.[78] Of critical significance is evidence that physical activity behaviors tend to aggregate within a family. That is, active parents tend to have active children. For example, using objective measures of physical activity, the Framingham Heart Study reported that young children with two active parents were 5.8 times more likely to be active than children with two inactive parents.[79]

Family and home-based interventions can include one or more approaches to support behavioral change, including informational and educational (for parents and children), behavioral and social (exercise or fitness programs), and policy and environmental (family policies for outdoor time, access to equipment). In addition, parents and other family members play important support roles for interventions that primarily take place in settings other than the home, such as schools. Interventions that target the home should reflect the reality that families are complex, dynamic, and encompass a variety of structures and cultures.

Conclusion

Evidence is insufficient that interventions strategies in the family and home increase physical activity among youth.

Supporting Discussion

Few studies have specifically examined the effectiveness of interventions in the family and home setting. Of these few, methodological problems, including the lack of long-term follow-up, poor validity

676 of selected physical activity measures, small study samples, and limited information on intervention
677 fidelity and implementation, hamper clear conclusions.
678 Three reviews were identified that specifically focused on family and home-based interventions
679 were identified.[76, 80, 81] There is evidence of no effect through sending materials home through
680 newsletters or homework, or by physical activity programs in which parents and children participate
681 together. Earlier reviews, which indicated positive effects for increasing physical activity if the
682 interventions were located in the home and included self-monitoring, goal setting, and in-home
683 activities, were not successfully replicated in later research. Although inconclusive, some evidence exists
684 to support interventions involving direct contact with the parents, those in which parents are
685 responsible for the participation of their children and the implementation of the intervention, and those
686 in which families are engaged through organized activities in which the families are already involved.

Next Steps for Research in the Family and Home Setting

- **Conduct longitudinal, observational studies to examine the relevance of family and home-based strategies throughout childhood and adolescence.**
- **Conduct longitudinal, observational studies to delineate which components of family life influence children's physical activity behavior.**
- **Test specific strategies that engage parents and other family members in physical activity promotion in the home setting.**
- **Test specific strategies that enrich the home environment to favor activity over sedentary pursuits.**
- **Compare intervention effects across race, ethnicity, and socioeconomic groups.**

687

Primary Health Care Setting

The health care system provides a promising opportunity to promote physical activity in youth. Virtually all residents of the United States younger than the age of 18 see a primary care provider at least annually, when physical activity can be assessed and counseling can occur. Because of the focus on prevention services during these visits, health care providers are in a unique position to promote physical activity among their patients. A nationally representative survey of primary care providers found that, among pediatricians and family practice physicians who care for pediatric patients, nearly all patients (98%) were asked general questions about the amount of physical activity they did, and two-thirds (66%) were asked specific questions about duration, intensity, and type of physical activity.[82] This suggests that clinicians providing care to pediatric patients may be open to effective counseling interventions. Because of the large number of youth who can be reached, primary care setting interventions can be extremely cost-effective.

Federal and organizational initiatives and recommendations advocate primary care as an appropriate setting for interventions. For example, the Healthy People 2020 objective PA-11.2 is to increase the proportion of physician visits made by all child and adult patients that include counseling about exercise.[42] Starting in 2009, youth physical activity assessment and counseling are measured as part of determining the quality of preventive health care of children and adolescents through the Healthcare Effectiveness Data and Information Set (HEDIS), a tool used by more than 90 percent of America's health systems to measure their quality performance.[83] These policy strategies, along with required measurement indices, indicate a supportive environment for physical activity counseling interventions for youth in the primary care setting. This appeal undoubtedly comes from counseling successes with other health behaviors. For example, the United States Preventive Services Task Force recommends counseling to prevent sexually transmitted infections in "at risk" adolescent populations.[84] Effective strategies in this context were of moderate to high intensity and included individual and group counseling.

Conclusion

Evidence is insufficient that strategies implemented in primary health care settings increase physical activity among youth.

Supporting Discussion

No reviews specifically focused on the primary care setting, although three included this setting as part of their multi-setting examination of the data.[24, 48, 85] In these reviews, six intervention studies were identified; only one included a control group. Three studies were conducted in Europe and three in the United States. Two studies found no difference in physical activity after a primary care intervention, and four found some increase from baseline, although most measures of physical activity were self-reported and the studies did not report validity and reliability of the physical activity measure. The controlled study did not observe a difference between the intervention and control groups when physical activity was assessed with accelerometers. The studies varied in their approaches so any effective intervention components could not be determined.

The reviews identified a variety of intervention strategies, including brief, extended, or tailored counseling; parental involvement; telephone follow-up; materials sent home; and websites. These components may have been conducted in combination, but little information is available to identify which may be more successful than others. Because of the insufficient information on the validity and reliability of the physical activity assessment methods and the pre- post- study design for most studies, the positive results found in some studies need verification from studies using high-quality study designs. Finally, half of the studies were conducted outside of the United States in countries with different health care systems, which calls into question how replicable potentially effective strategies may be.

Next Steps for Research in the Primary Care Setting

- **Conduct randomized, controlled studies of the effectiveness of primary care counseling on physical activity behavior, using state-of-the-art physical activity measures.**
- **Identify the optimal intensity and delivery mode of primary care physical activity interventions.**
- **Identify the optimal age range for effective interventions in primary care settings, as well as intervention effects in healthy, normal weight as well as overweight or obese youth.**
- **Examine strategies to promote physical activity in different primary care settings, including integrated health care, fee-for-services, and community clinics.**
- **Conduct cost-effectiveness research to identify the most efficacious intervention once promising interventions are identified.**
- **Compare intervention effects across race, ethnicity, and socioeconomic groups.**

The Role of Policy

Policies and programs can shape environments that promote (or impede) physical activity. They have broad reach across the population and are therefore potentially powerful tools to increase physical activity and fitness. With increased attention on the current and future health of America's youth and efforts like the First Lady's *Let's Move!* initiative, policymakers' interest in youth physical activity has increased, with improved physical activity levels seen as a goal in itself, as well as a component of comprehensive efforts to address rates of childhood obesity.

Policy involvement in youth activity has ample precedent, including mandated school PE and Title IX of the Education Amendments of 1972. Two examples stand out in particular:

- PE has been an institution in American schools since the late 19th century, and currently most states mandate PE for students in elementary (84% of states), middle (76%) and high schools (90%). Although the quality and quantity of PE actually provided to U.S. students typically falls below recommended standards, the high prevalence of state-mandated PE constitutes a longstanding, widespread and important policy that directly supports provision of physical activity to students.[86]
- In 1972, Congress passed and President Nixon signed Title IX legislation that banned exclusion from educational programs and activities on the basis of gender. Over the following four decades, this legislation has transformed sport participation opportunities for girls and women in American high schools, colleges, and universities. According to the National Federation of State High School Associations, girls' participation in high school sports programs has increased from less than 300,000 in 1971–1972 to more than 3.2 million in 2011–2012.[87] Title IX, a policy aimed primarily at addressing gender inequity, has clearly expanded physical activity opportunities tremendously for millions of adolescent girls.

The *Mid-course Report* has considered only published reviews examining the evidence related to certain settings and youth physical activity. Although individual articles have assessed the implementation and/or content of policies related to youth activity[88–90] as well as associations between different policies with youth activity,[91–93] no extant reviews have directly examined policy and youth physical activity. Nevertheless, it is important to note that policymakers have authority over several of

the settings identified in this report as potentially important avenues for increasing youth physical activity, and for which research reviews indicate beneficial effects:

- **Schools** can influence activity in youth through PE, recess, other activity breaks, active transportation to school, and other enhancements to the school environment. Promoting physical activity in schools has traditionally been part of the U.S. education system, and research indicates its beneficial effects on both health and education. A growing body of research addressing the association between physical activity and academic achievement indicates that school-based physical activity can improve grades, standardized test scores, cognitive skills, concentration, and attention. (See the School section of this report for more details.)
- **Preschool and Childcare** settings appear to be an important venue in which activity levels of young children may be affected. These effects occur through providing portable play equipment on playgrounds and other play spaces, providing staff with training in delivery of structured physical activity sessions for children and increasing the time allocated for such sessions, integrating physically active teaching and learning activities into pre-academic instructional routines, and increasing time that children spend outside. Policies promoting structured physical activity in childcare should consider the need for teacher training, as research suggests that teachers' knowledge about physical activity, motor development, and their ability to support children's learning and development is important. Physical activity can and should be integrated into the daily routines and existing curricula of preschools, and should not be seen as something that competes with other educational goals. (See the Preschool and Childcare Centers section of this report for more details.)
- Aspects of the **built environment** appear to influence youth activity, specifically those under the jurisdictions of urban planning, transportation, and parks and recreation. Examples include: modifications that encourage active transportation, walking and biking, pedestrian safety, reduced traffic speed and volume, reduced incivilities and disorders (such as litter and vacant lots), and access to, density of, and proximity to places for youth to be active, such as parks and recreation centers. (See the Community section of this report for more details.) It is worth noting that policies encouraging increased active transportation among youth—namely, walking or biking to school or other destinations—may have the triple benefit of improving children's cardiometabolic health as well as improving air quality and environmental sustainability.

- **Social marketing** is another method available to policymakers for increasing physical activity in youth, and research suggests that targeted media campaigns have improved other youth health behaviors, such as smoking.[94, 95] Although results of mass media campaigns to increase physical activity have been mixed,[96] a notable success is the VERB™ campaign, discussed in greater detail on p. 42.

All levels of government are able to play a role in shaping policies and programs that have sufficient or suggestive evidence that they increase youth activity. At the local level, municipal and county governments are responsible for managing the built environment directly, and local school districts influence activity-related policies within their jurisdictions, such as PE requirements. At the state and national level, policymakers can exert substantial influence through legislation, appropriations, and other incentives related to urban planning, transportation, parks and recreation, education, and childcare. Examples include a recent policy change in Massachusetts for minimum activity requirements in childcare, and the national Safe Routes to School program from the U.S. Department of Transportation.[97] It is especially important to engage partners from a variety of sectors in health-related policymaking in the quest to increase physical activity in youth.[98]

ADDITIONAL APPROACHES TO BUILD A MORE ACTIVE FUTURE FOR YOUTH

The evidence weighed in this *Mid-Course Report* includes information from published review articles. As such, some strategies could not be addressed because they are too new to have been attempted very often, too new to have generated a review paper, or underused for other reasons. However, they may be promising for increasing physical activity, and the subcommittee felt it was necessary to identify these strategies as areas for future investigation. These strategies include social marketing, social media and Internet-based approaches, active video games, mobile phones, and outdoor activities.

VERB

When planning for strategies to increase physical activity in U.S youth, much can be learned from successes of the past. The VERB™ campaign is one recent example of a population-based approach that increased physical activity among U.S. youth. The 2001–2006 VERB campaign was a national, multicultural, social marketing campaign coordinated by CDC. Funded at $339 million over 5 years, the mission of VERB was to increase and maintain physical activity among U.S. youth ages 9 to 13 ("tweens"). This age group was selected because of the precipitous decrease in physical activity that occurs during adolescence. Campaign planners made significant efforts to involve tweens themselves and, in fact, the name of the campaign—*VERB*—and its tagline—*It's what you do!*™—were chosen because they were the most popular options among participating tweens.

VERB used a social marketing approach in a campaign to deliver a positive and educational message about physical activity through media messages delivered by television, radio, and newspaper advertising; school and community promotions; the Internet; and national and local partnerships. Messages were tailored to reach a general audience of tweens and their parents, as well as specific racial and ethnic groups.[1] To extend its reach, the campaign also engaged other adults with influence in the life of tweens, such as teachers, youth leaders, PE and health professionals, pediatricians, health care providers, and coaches.

VERB had many successes, demonstrating that a concentrated marketing campaign, with substantial funding and a multi-sector approach, can positively affect physical activity levels in youth. At the end of

the first year, nearly three-quarters of tweens surveyed were aware of the campaign, and those who were aware were more likely to report participating in physical activity during their free time than were those who were unaware of the campaign.[99] After two years, the program showed a dose-response effect, namely that greater reported frequency of exposure to VERB messages was associated with more reported activity in tweens.[3] Awareness of the VERB campaign remained high over time—three-quarters of tweens were aware of the campaign toward the end of the funding period in 2006, and again, tweens exposed to the campaign were more likely to report being physically active than were those who were unaware of the campaign. Finally, evidence suggests that exposure to VERB during the tween years had carry-over value into adolescence (youth ages 13 to 17). Tweens experiencing greater exposure to VERB reported higher benefits of physical activity and greater amounts of free-time physical activity.[100]

Today's tweens are different from those who originally contributed to the development and successes of VERB. For one thing, in the 10 years since VERB began, the way tweens receive and share information has changed dramatically. A national effort replicating the successful strategies used in the VERB campaign must address today's youth. In order to capitalize on the prior success of VERB, any future physical activity efforts must incorporate technology, social media, and the Internet to an even greater degree than did VERB.

Technology-based Approaches

Social media and Internet-based approaches involve the use of Facebook, Twitter, other similar social media avenues, and websites. The Internet is a megatrend. That is, it is a major force in societal development that will continue to shape people's lives during the next 10 to 15 years at the global level.[101] Data from the 2010 U.S. Census indicate that 76 percent of U.S. residents ages 3 and older live in a household with Internet access, and 65 percent of residents ages 3 and older access the Internet at home.[102] The Pew Internet Survey reported that 95 percent of youth ages 12 to 17 are Internet users and 80 percent use social media sites.[103] Almost all U.S. children and adolescents can be reached through social media and Internet-based programming. Clearly, children and adolescents are interested in these types of activities, and researchers should continue to explore their potential uses in interventions to increase physical activity.

Children and adolescents are increasingly exposed to new technology that they have embraced. Technology applied at increasing physical activity is a developing strategy with wide open possibilities. For example, active video games ("exergames") and mobile phone technologies have increased exponentially increased. A 2008 Pew Report noted that 97 percent of youth ages 12 to 17 play video

games, with 50 percent reporting they played the previous day.[103] Approximately 86 percent play on some type of console.[103] In a recent review of active video game interventions in children and adults, Evidence is not yet sufficient to suggest that playing active video games increases physical activity, however, technology in this area is rapidly changing, rendering some of the postulated reasons for indeterminate effects obsolete.[104] For example, platform changes introduced by the video game industry now force players to actually move during games instead of simulating movement with a game controller while sitting.

Mobile phones are another social media and Internet device whose use has skyrocketed in recent years. A July 2011 Pew Internet Survey noted that 77 percent of youth ages 12 to 17 had a mobile phone, and the number of smartphones used in this population is on the increase.[103] Apps are now available that track physical activity. For example, the inclusion of Global Positioning Systems (GPS) and accelerometer technology in mobile phones allows programs to estimate the number of miles walked per day. Children and adolescents are drawn to these types of tools and may increase physical activity just to be able to use the tools for fun.

Playing Outdoors

In addition to these new technologies, some tried-and-true methods have great merit and should continue to be emphasized in future interventions. It may seem intuitive and therefore seldom designated as a specific strategy, but simply getting children and adolescents to spend time outdoors is a simple and low-cost approach for increasing physical activity because almost all outside child and adolescent-appropriate activities encourage some level of physical activity. Several studies have shown, across a wide range of age groups, that spending time outside is associated with increased levels of moderate-to-vigorous intensity physical activity.[105–110] Additionally, studies have shown that dog ownership is related to physical activity among adolescents,[111] suggesting that taking the dog for walks may increase physical activity. In contrast to technology-based activities, which primarily take place indoors, encouraging children to spend time outdoors may provide extra benefit because being physically active outside creates positive feelings about exercise.[112] In addition, some activities that are most easily accommodated in outdoor settings, such as jumping rope, playing hop-scotch, and doing hip hop dance moves, have specific and substantial health benefits, including developing strong bones.[113]

In summary, social marketing, social media and Internet-based approaches, active video games, mobile phones, and outdoor activities all have promise for increasing physical activity in youth, despite the current lack of evidence for employing them. Other strategies not mentioned in this document, such

as focusing on social aspects of physical activity, may hold promise as well. The subcommittee recommends creative thinking as we move into the future. It also is important to remember lessons learned, in particular the one from VERB indicating that we should include youth—the primary audience we wish to reach—in designing and implementing physical activity interventions, in order to increase likelihood of success.

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